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MEMORANDUM

To: T.C. Greengard 1801-03
From: B.P. Doty
Date: May 15, 1989

Subject: Surface Water Monitoring Program

This memorandum presents a surface water monitoring program for the Rocky Flats Plant. The goals of the program are to begin to quantify the surface water system and to monitor for off-site releases via the surface water pathway (including sediments). The memo describes the locations of the monitoring stations and specifies the parameters to be measured at each of the stations. In addition, the monitoring methodology is described.

MONITORING SYSTEM

It is suggested that a surface water monitoring system consisting of 14 stations be installed at the plant. Flow rate, water quality, and sediment quality will be monitored at each station. In addition, the timing, quantity and quality of precipitation events will be monitored at three stations. The stations are identified on Figure 1 and the rationale for the station locations is presented in Tables 1 through 5. To the extent possible, existing surface water monitoring stations are used in this system; however, five new stations are proposed. The new stations are indicated with letter designations in this memo and on Figure 1.

The intent of the monitoring system is to provide:

1. background flow and water/sediment quality data from areas that have not been affected by plant operations,

2. flow and water/sediment quality data of plant run-off and streamflow that may be affected by plant operations, and

3. flow and water/sediment quality data at points of discharge from the plant.

All samples (surface water, sediments and rainfall) will be analyzed for the parameters shown in Table 6.

The timing of both the precipitation event and the arrival of run-off will be monitored at the precipitation monitoring stations (B, D and SW-3). Electrical power to run continuous strip chart recorders is believed to be relatively convenient to these stations. The stations were selected to be upstream of the plant (B), within the plant itself (D) and downstream of the plant (SW-3). SW-1 was not selected as the downstream precipitation sampling station because of potential interference from wind-blown particulates from historic (as opposed to current) releases from the plant.

MONITORING EQUIPMENT

Surface Water Flow and Quality

Flow and quality will be monitored using Parshall flumes coupled with electronic transducer based depth recording and run-off event actuated samplers. The timing of the run-off event will be recorded at the stations with electrical power (B, D, and SW-3). At the other stations, the battery operated flow meter and recorder will be actuated by the presence of water; therefore, the time at which the runoff event began will not be known. All stations can record the time of arrival of the runoff event if the plant is willing to change batteries frequently (weekly, or at best, monthly).

Currently, it is assumed that a flume with a 36-inch throat width (29 cfs capacity) will be sufficient for this application. It is suggested that the sampler be an ISCO composite sampler (or equal) that is activated by the presence of water in the stream. Approximately 250 milliliters of sample be collected every minute, so that a four gallon sample is collected from a one hour run-off event. Eight four-gallon bottles can be connected in a cascade system so that an event lasting eight hours can be completely sampled.

Sediment Chemistry

Two types of sediment samples will be collected. Suspended sediments will be collected with the water samples and quantified by the total analyses (analyses of unfiltered samples). Bedload transported sediments will be collected using a pit sampler (Hubbell, 1964). The pit sampler will consist of a stainless steel tray approximately 3 feet by 3 feet in plan and 12 inches deep. The tray will be placed in a

concreted channel section downstream of the Parshall flume (Figure 2) and will collect the bedload transported through the flume.

It is possible that large run-off events will completely fill the tray and that some bedload will not be collected as it moves over the top of the filled tray. However, it is felt that the collected portion will be sufficient to characterize the chemistry of the transported material. Alternatively, small events may not deposit enough material for complete chemical characterization. In this case, only the radioactive constituents will be analyzed.

Precipitation Quantity, Timing and Chemistry

Precipitation will be collected using a 4 foot diameter stainless steel funnel. This size was selected to produce four gallons of sample from a 1/2-inch precipitation event. Discharge from the funnel can be directed to a cascade sample bottle system so that larger events can be sampled. In order to minimize inclusion of dust on the funnel in the sample, the funnel should be rinsed weekly with deionized water. The sampling apparatus will be paired with tipping bucket rain gage and event recorder to determine the timing and amount of the precipitation event. Snow fall will not be monitored directly; however, run-off from snowmelt will be monitored by the surface water stations.

CONCEPTUAL COST ESTIMATE

A conceptual cost estimate for the above proposed system has been prepared, indicating that the installed equipment will cost approximately $128,400. This cost does not include routine maintenance, sampling or analyses.

The most expensive component of the sampling system is the surface water station, especially the flow meter and sampler. Clearly, the total cost can be significantly lowered by reducing the number of sampling stations.

REFERENCES

Hubbell, D.W., 1964, Apparatus and Techniques for Measuring Bedload, U.S. Geological Survey Water-Supply Paper 1748.

Table 1. Monitoring Stations on Woman Creek

Station	Function
A	Station is intended to provide background data for the Woman Creek Drainage. The station is located immediately downstream of Highway 93 (discharge from culvert beneath the highway) because the plant property does not extend sufficiently far to the west along Woman Creek to allow installation of a station that is up-gradient of the West Spray Field.
SW-28	Station is located on Woman Creek immediately upstream of Pond C-2 (receptor of interceptor ditch discharge) to evaluate effectiveness of the ditch.
SW-27	Station is located on the South Interceptor Ditch immediately upstream of its discharge point at Pond C-2. The station is intended to evaluate the quality of run-off from the southern portions of the plant.
SW-1	Station is located at the eastern plant boundary to evaluate the quality of run-off from the plant as it exits the property and to evaluate the effectiveness of the plant run-off control system (Interceptor Ditch and Pond C-2).

Table 2. Monitoring Stations on South Walnut Creek

Station	Function
D	Station is located at the discharge point from the buried culvert at the headwaters of South Walnut Creek. The station is intended to provide background quality data for the creek before it is potentially impacted by flows from downstream footing and hillside drains.
SW-25	Station is located below the B-series ponds but upstream of the confluence with North Walnut Creek. The station is intended to monitor the effectiveness of the B-series run-off control systems and to evaluate potential water quality degradation in the drainage before it mixes with North Walnut Creek. Additional stations could be installed along the drainage upstream of this point; however, additional stations are not included in order to maintain the manageability of the program. Also, additional stations are not needed if there is no quality degradation between D and SW-25. If quality degradation is indicated, additional stations can be installed at a later date.

Table 3. Monitoring Stations on North Walnut Creek

Station	Function
B & C	These stations are located on the Upper Church Ditch and McKay Ditch at their points of discharge from culverts beneath Highway 93. The intent is to provide background data for North Walnut Creek to which these ditches are tributary. The creek itself has headwaters in the West Spray Field, which means that unimpeachably non-impacted samples cannot otherwise be collected.
SW-92	The station is located downgradient of the plant but upgradient of the A-series retention ponds. The intention is to collect plant-specific data to isolate the effects of run-off and seepage from plant areas from pond seepage farther downstream. Additional stations between B & C and SW-92 can be installed to further investigate the source of any quality degradation.
SW-16	This station is located immediately above the confluence of North Walnut Creek, South Walnut Creek and Dry Creek (note new name for the Landfill Tributary). The station is intended to allow differentiation of water quality between the three drainages.
SW-3	This station monitors the combined flow from North Walnut Creek, South Walnut Creek and Dry Creek at the point of discharge of the creeks from the plant property. The station will allow monitoring for surface water releases from the plant.

Table 4. Monitoring Stations on Dry Creek

Station	Function
E	Station E is intended to monitor the performance of the landfill and to identify quality changes between this station and the next station downstream (SW-15). Elevated total dissolved solids (and specific major ions) have been identified in the ground water between these stations, which are tentatively attributed to natural geochemical variability. However, this chemical condition may also indicate either historic or on-going releases from the landfill. If the releases are on-going, degraded quality should be detectable in the surface water near the fill which may be non-detectable farther downstream due to dilution and attenuation. Therefore, Station E is proposed near the fill.
SW-15	This station is located immediately above the confluence of North Walnut Creek, South Walnut Creek and Dry Creek. The station is intended to allow differentiation of water quality between the three drainages.

Table 5. Monitoring Stations on Rock Creek

Station	Function
SW-4	SW-4 is located at the most downstream point on Rock Creek that is still within the plant property. The station is intended to provide flow and quality data from an unimpacted drainage. Rock Creek is believed to be unimpacted because no plant related activities have occurred in the drainage.

Table 6. Surface Water Quality Analytical Parameters

Indicators

Total Dissolved Solids
Total Organic Halides
Total Organic Carbon
Total Suspended Solids

Organics

HSL Volatiles
HSL Semi-Volatiles (BNAs)
Pesticides/PCBs

Inorganics

Nitrate
Nitrite
Total Kjeldahl Nitrogen
Ammonia

Radionuclides

Uranium 233+234, 235, and 238
Plutonium 239+240
Tritium

Metals

Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Potassium
Selenium
Silver
Strontium
Thallium
Vanadium
Zinc

Notes:

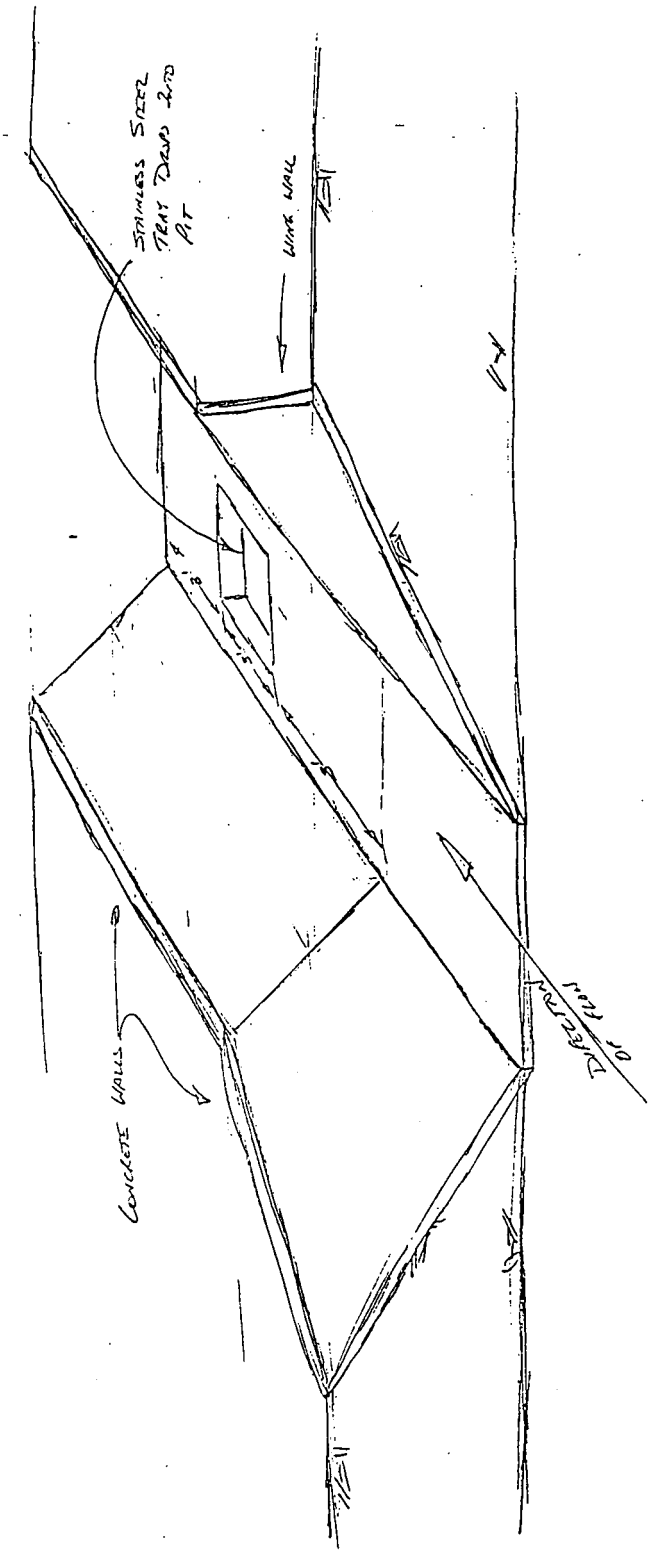
1. HSL = Hazardous substance list.
2. BNAs = Base-neutral/acid extractable compounds.
3. PCBs = Polychlorinated Biphenols.
4. All parameters will be analyzed on both total and dissolved bases, except the indicator parameters (analyzed as specified in SW-846) and tritium (analyzed on a dissolved basis only).
5. BNAs and pesticides/PCBs will be analyzed twice during the first year (April and October) and annually during later years. If any compounds in these general classes are detected during the annual monitoring, analyses will be repeated for the entire class of compound during the next sampling event.

Table 7. Conceptual System Cost Estimate

Item	Unit Cost	Quantity	Extended Cost
SURFACE WATER STATIONS			
Parshall Flume	$900		
Flume Installation	500		
Flow meter	3,000		
ISCO Sampler	3,000		
Bottle Cascade System	500		
Total	$7,900	14	$110,600
SEDIMENT STATIONS			
Tray	$150		
Control Section	500		
Total	$650	14	$9,100
PRECIPITATION MONITORING STATIONS			
Stainless Funnel	$200		
Bottle Cascade System	500		
Rain Gage	600		
Event Recorder	1,100		
Installation	500		
Total	$2,900	3	$8,700
TOTAL SYSTEM COST			$128,400

FIGURE 2.

PIT SAMPLER INSTALLATION



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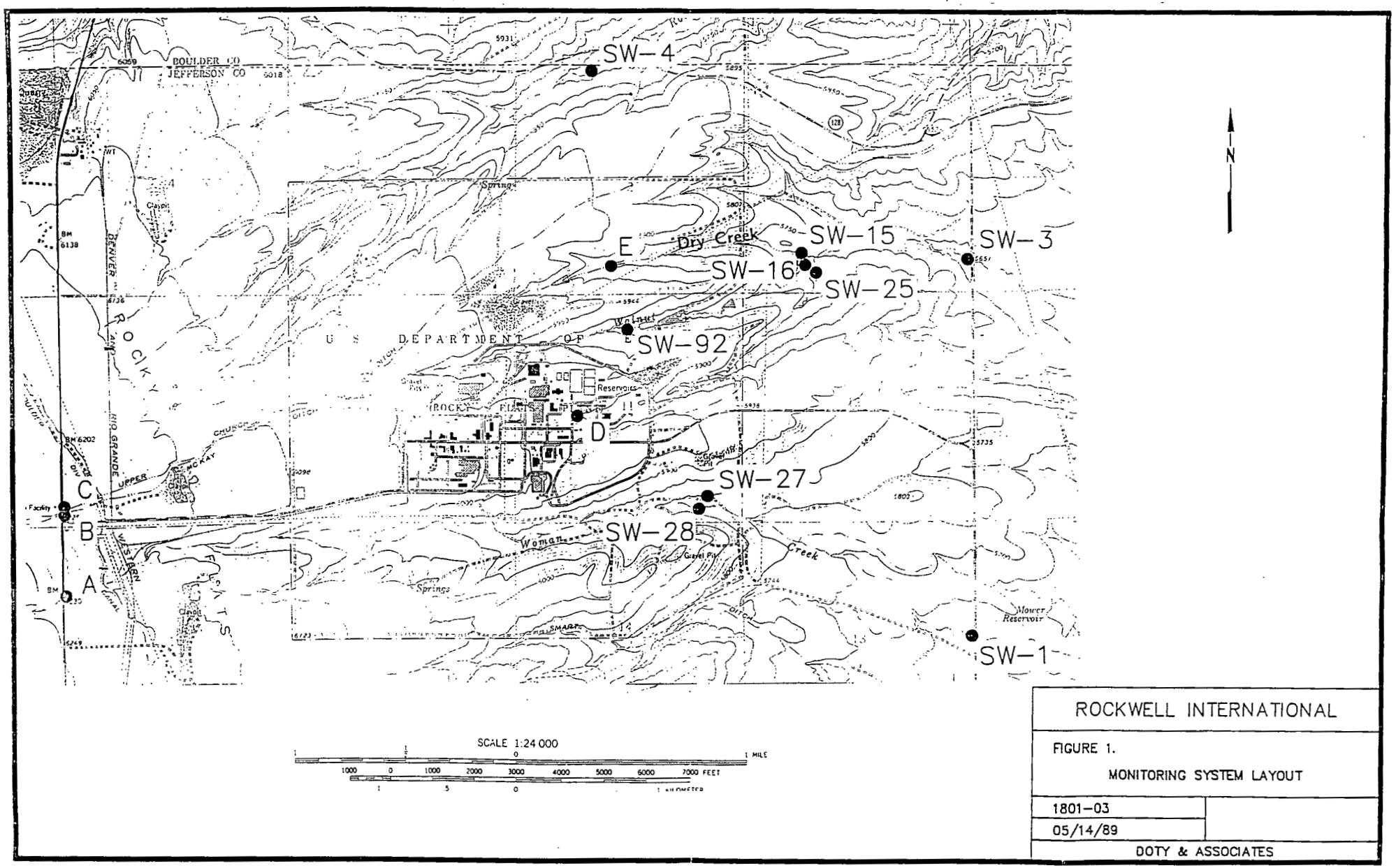

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FIGURE 1.
MONITORING SYSTEM LAYOUT

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